الجامعة السعودية الإلكترونية
SAUDI ELECTRONIC UNIVERSITY
2011-1432

College of Computing and Informatics

Digital Logic Design

CS231

Project

Deadline: Tuesday 14/12/2021 @ 23:59

[Total Mark for this Project is 10]

Student Details:

CRN:

Name: ###
Name: ###
Name: ###
Name: ###

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Instructions:

- You must submit two separate copies **(one Word file and one PDF file)** using the Assignment Template on Blackboard via the allocated folder. These files **must not be in compressed format**.
- It is your responsibility to check and make sure that you have uploaded both the correct files.
- Zero mark will be given if you try to bypass the SafeAssign (e.g., misspell words, remove spaces between words, hide characters, use different character sets, convert text into images or languages other than English or any kind of manipulation).
- Email submission will not be accepted.
- You are advised to make your work clear and well-presented. This includes filling your information on the cover page.
- You must use this template, failing which will result in zero mark.
- You MUST show all your work, and text must not be converted into an image, unless specified otherwise by the question.
- Late submission will result in ZERO mark.
- The work should be your own, copying from students or other resources will result in ZERO mark.
- Use **Times New Roman** font for all your answers.

Learning Outcome(s):LO3

Explain the process of integrated design of data paths and control units using register transfer statements and state machine diagrams

Project Description

1. Objectives

The main objective of this project is to get familiar with combinational and sequential digital circuit design and apply the concepts learned throughout the course, such as k-maps.

2. Introduction

In this project, you are asked to build a circuit with three inputs and three outputs. The inputs/outputs represent the numbers 0-7 in binary format. The output is a counter that follows the output as follow:

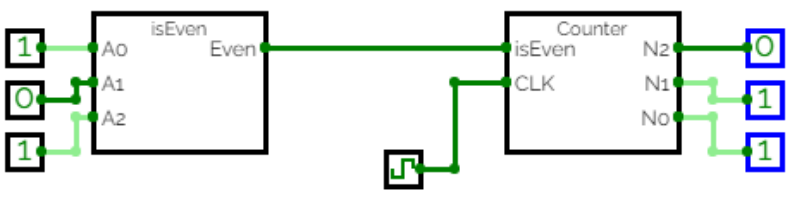
- If the input represents an even number (like 0 or 4), the output should count forward, i.e., 0➔1➔2➔3➔4➔5➔6➔7➔0➔1➔ etc.

- If the input represents an even number (like 1 or 3), the output should count backward, i.e., 7➔6➔5➔4➔3➔2➔1➔0➔7➔ 6➔ etc.

You will need to identify the input and output variables, decide which flip-flop to use, write the state table, use k-maps to simplify the inputs to the flip-flops, implement and verify the solution using the simulator in https://circuitverse.org/simulator

3. Required work

The final circuit should look something like this:



Project Description

You will first create a combinational circuit that takes three digits binary input and one output; the output should be 1 if the input is even and 0 if the input is odd.

The output of this circuit will be the input to the next circuit (the counter). Then you will design the counter circuit. If the input to the counter circuit is 0 the counter will count backward, and if the value is 1 the counter will count forward.

The following sections describe the details of the requirements.

Part 1- Combinational circuit to determine if the input is even or odd. **(2 Marks)**

a) Identify the input and output variables.
b) Write the truth table
c) Simplify the output function
d) Implement the function as a sub-circuit in circuitverse.org and attach a screenshot of the circuit design (**see the appendix on how to make a sub-circuit**)

Note: The answers should be supported with a screenshot. Marks will be reduced if no screenshot is given.

Part 2 – Counter that can count forward and backward based on input. **(5 Marks)**

a) Draw the state diagram
b) Select a flip-flop
c) Write the state table based on the state diagram and the selected flip-flop
d) Use k-maps to simplify the input equations to the flip-flops
e) Implement the counter as a sub-circuit in circuitverse.org and attach a screenshot of the circuit design (**see the appendix on how to make a sub-circuit**)

Project Description

Note: The answers should be supported with a screenshot. Marks will be reduced if no screenshot is given.

Part-3 – Combined circuit connecting the counter input to the output of the circuit in part 1. **(1 Marks)**

a) Create the main circuit like the circuit in section 3 above
b) Test the circuit with different inputs to make sure it functions correctly

Note: The answers should be supported with a screenshot. Marks will be reduced if no screenshot is given.

Part 4: Provide a link to your implementation in circuitverse.org or add the instructor as a collaborator to the project. (See the appendix for instructions) **(2 Mark)**

Note: Include the link to the completed circuit in circuitverse.org. If there is no link with your submission, your answers will not be validated.

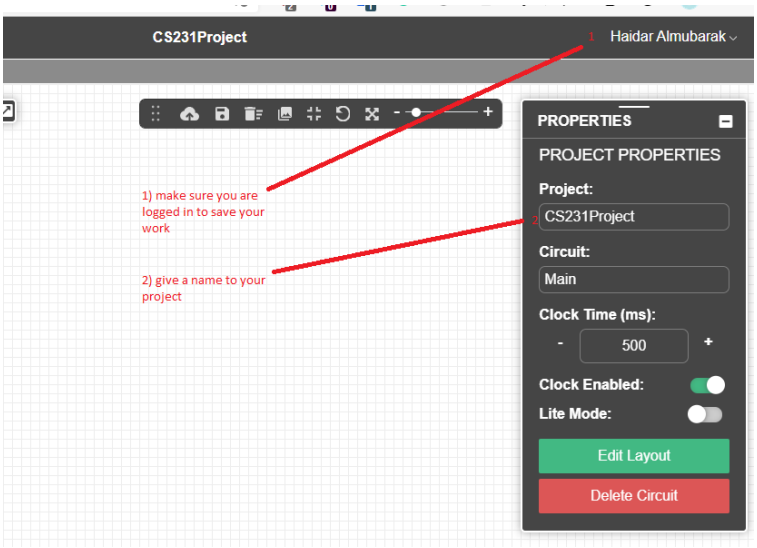
Answer:

Appendix

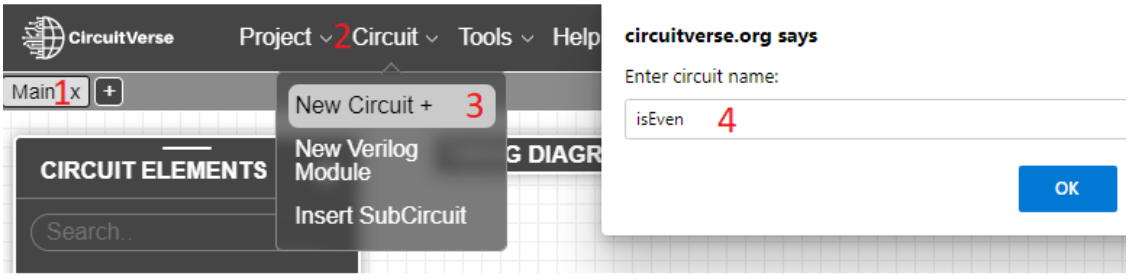
Create A project

Go to https://circuitverse.org/simulator and sign in (sign up if you don't have an account)

Create a project and name it something meaningful



Creating a new subcircuit



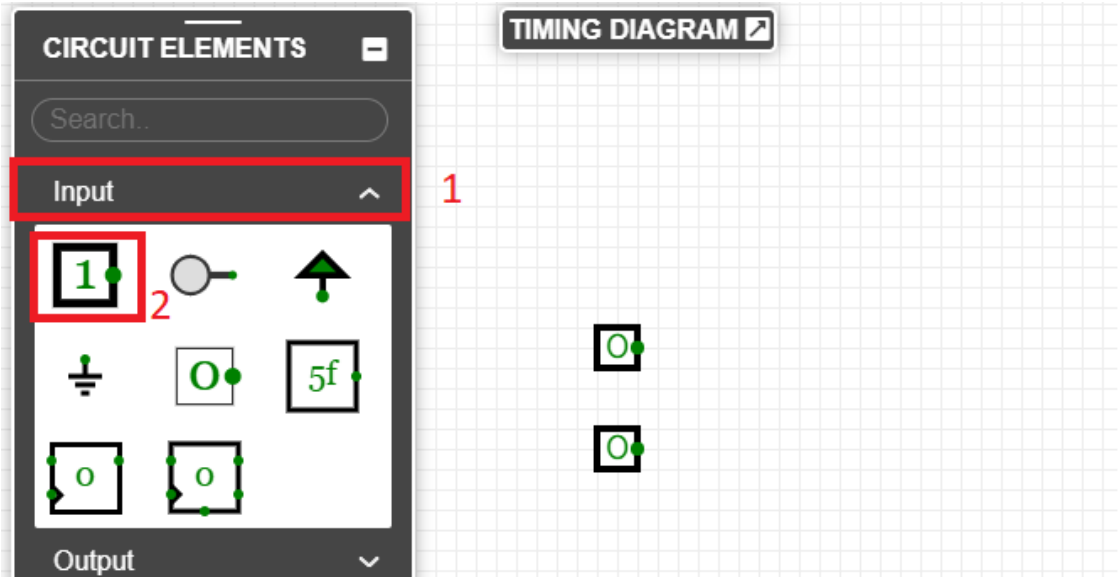
1 - The main circuit is where you will connect the two sub-circuits (the counter and the circuit that checks if the input is even).

2 - Click the Circuit menu.

3 – Select New Circuit to create a sub-circuit

4 - Give a name to the circuit.

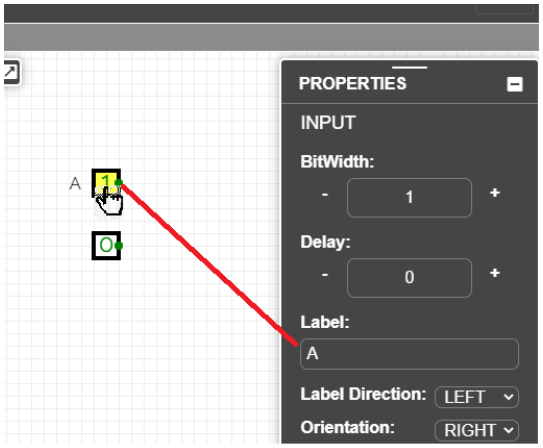
Building sub-circuits



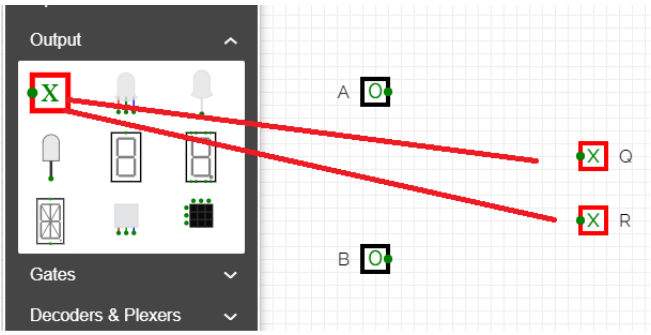
1 - expand the input section in the circuit element

2 - click the input element then click inside the canvas to insert the input terminal (you need to repeat this depending on how many inputs your circuit needs)

Appendix

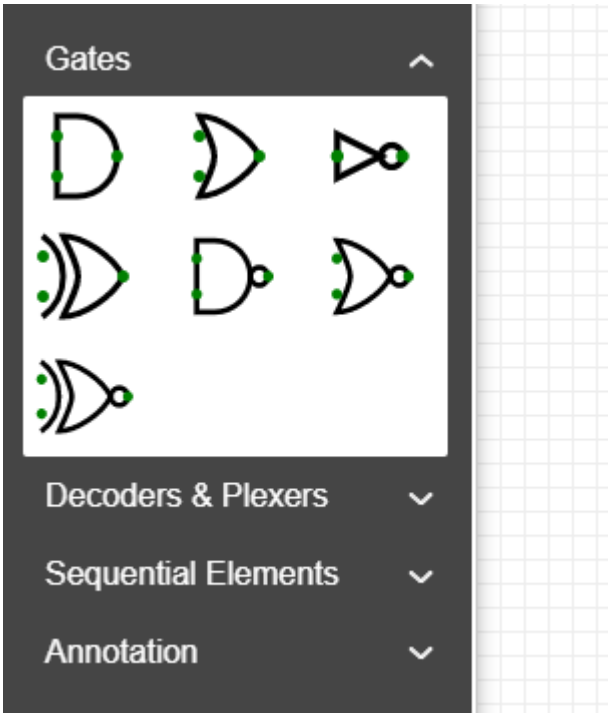


Select each input and the properties of it will show up from there give the proper label for that input.

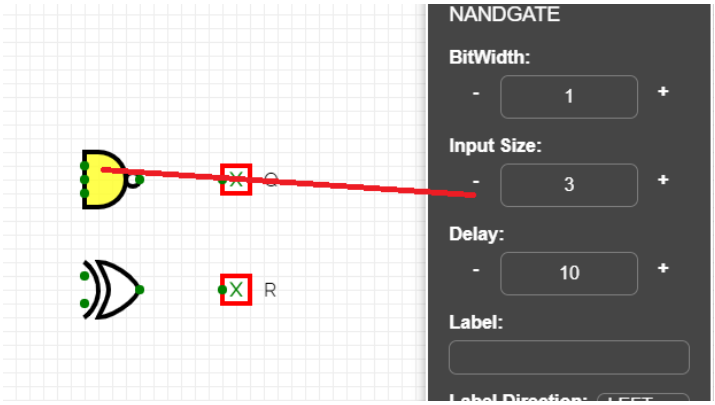


Do the same for the outputs

Appendix

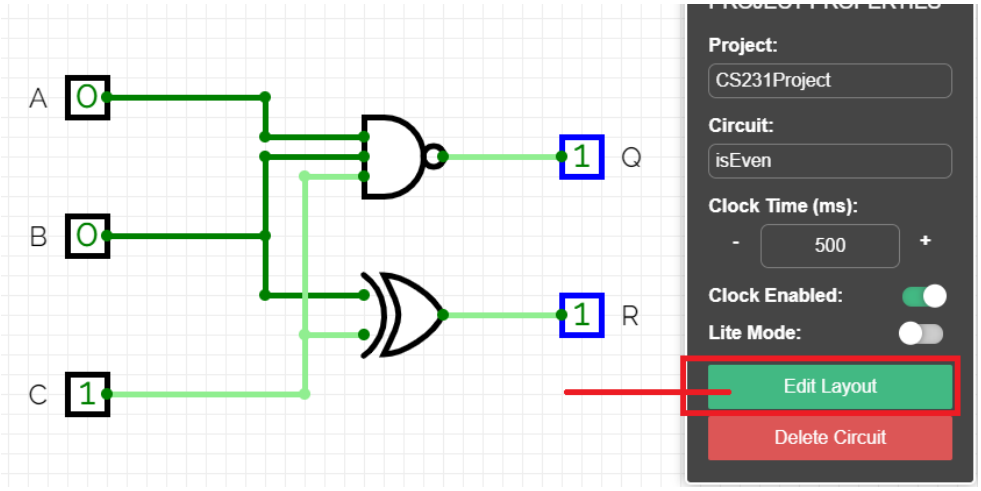


Depending on your design you will be using different circuit elements from the gates, decoders, or sequential elements

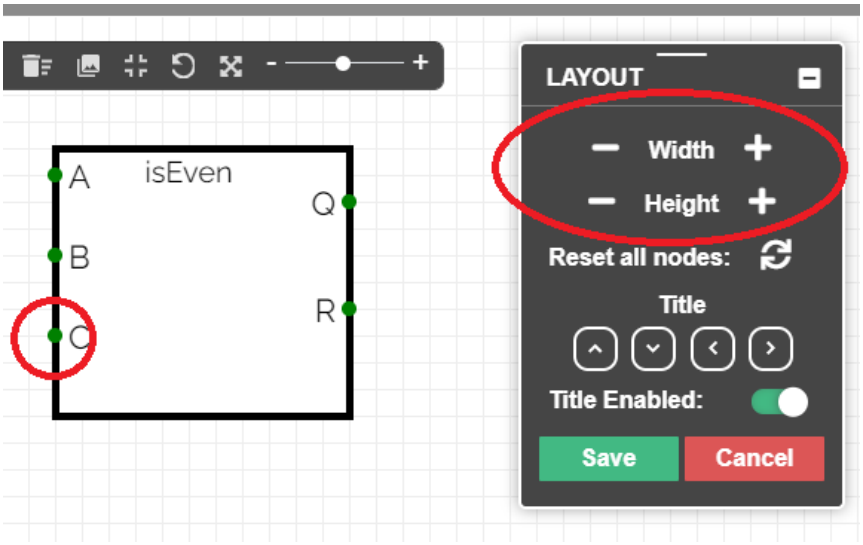


By default, the gates will have 2 inputs, if your design require more inputs for a gate, you can select that gate and from the properties area you can change the number of inputs for that gate.

Appendix

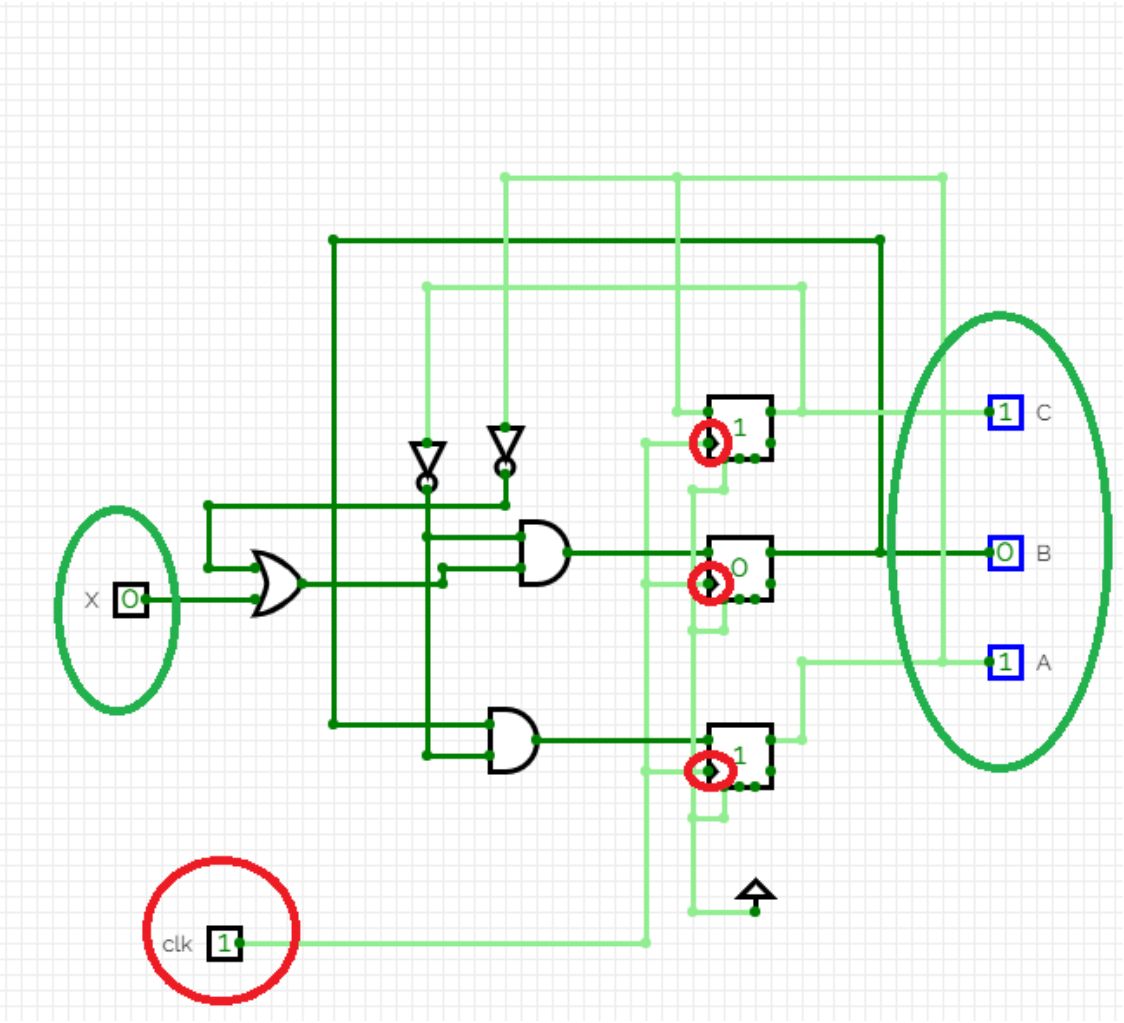


Once you finish your circuit you can click edit layout to see how this sub-circuit will show up if inserted inside another circuit



From there you can adjust the width and height of the circuit block diagram and move the input or output nodes to space them out.

Appendix

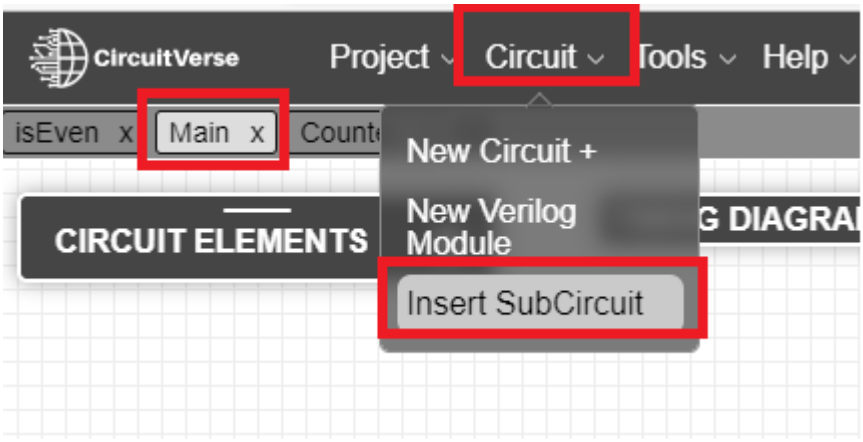


For the counter make sure all the clocks of the flip-flops are connected to a single input called clk or clock.

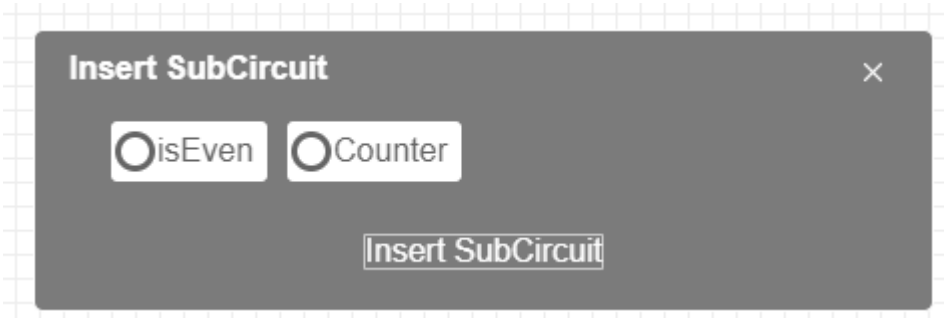
The enable can be connected to a power input, or it can have its own input line just like the clock

The input x is the one used to control the counting backward or forward

Making the main circuit

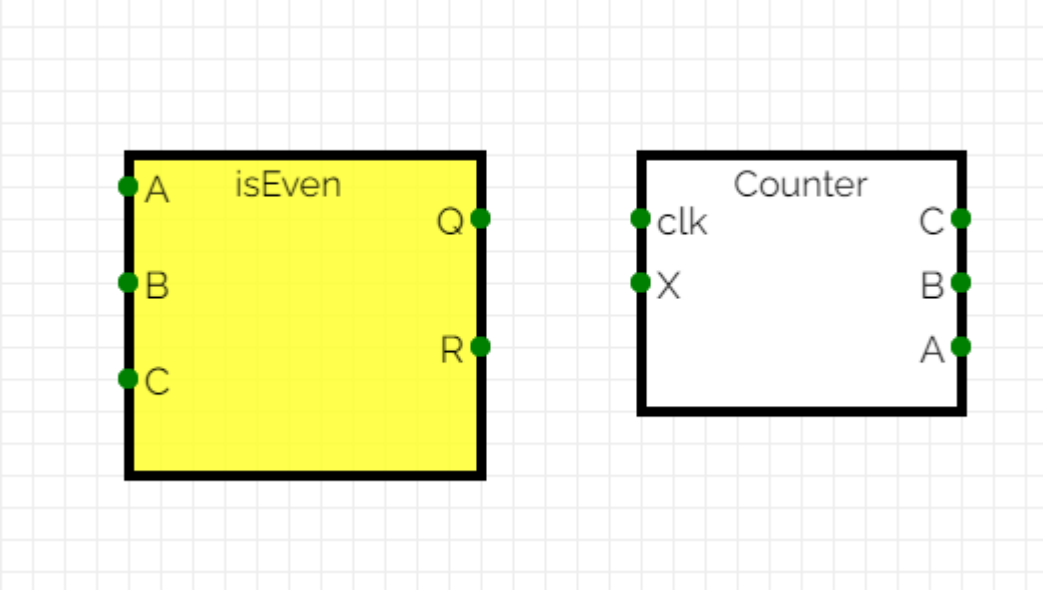


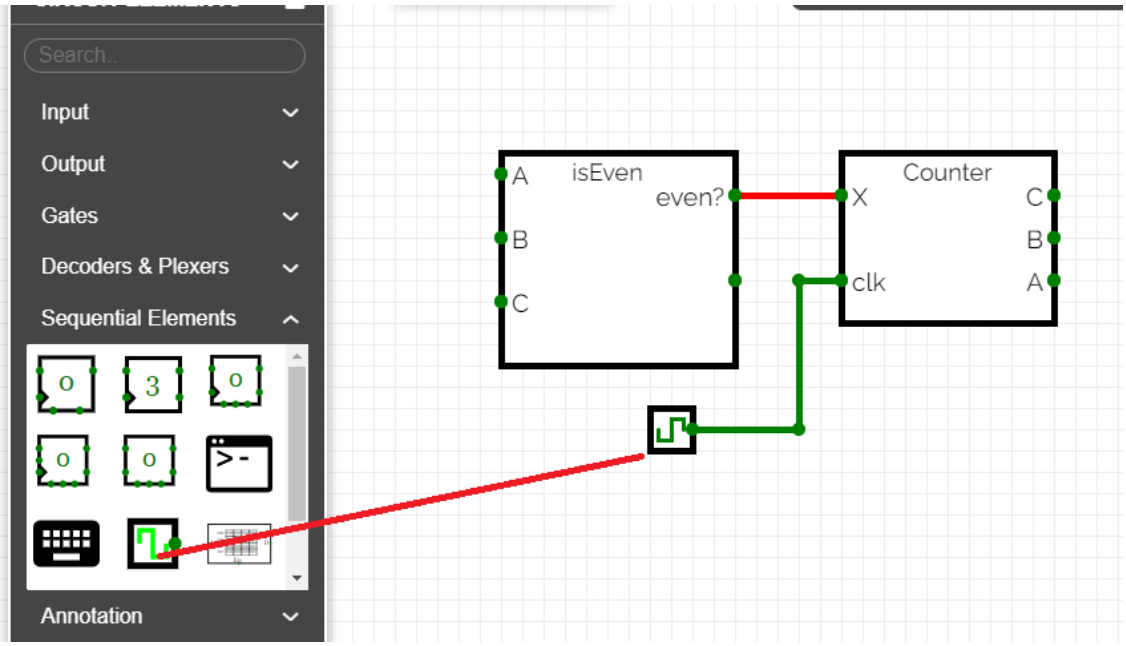
Open the Main diagram and from the circuit menu click insert SubCircuit



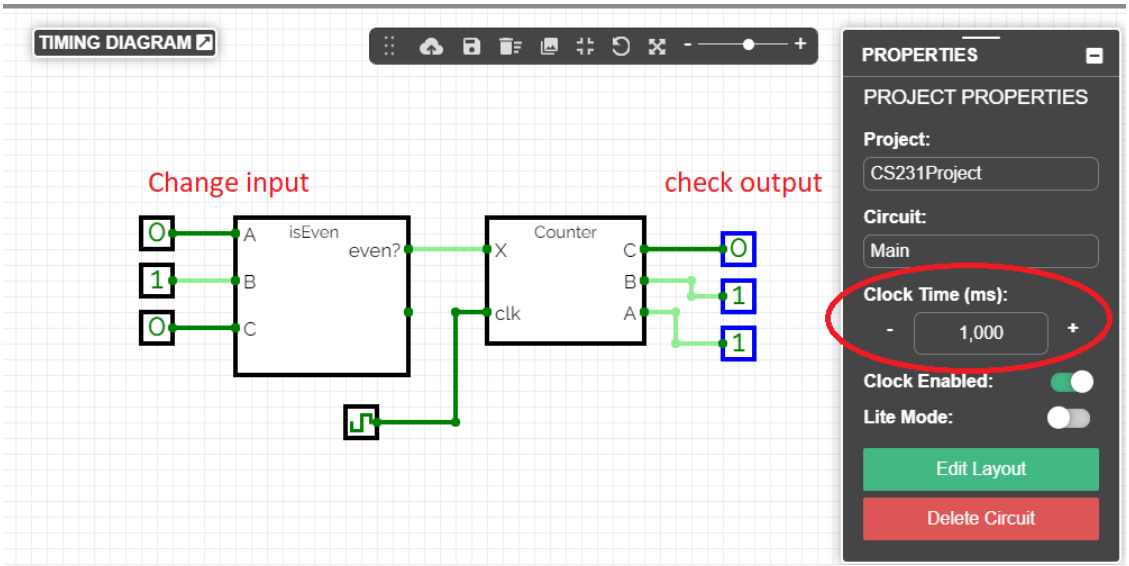
Do this twice to insert the isEven and the counter circuits then you should get something like this

Appendix





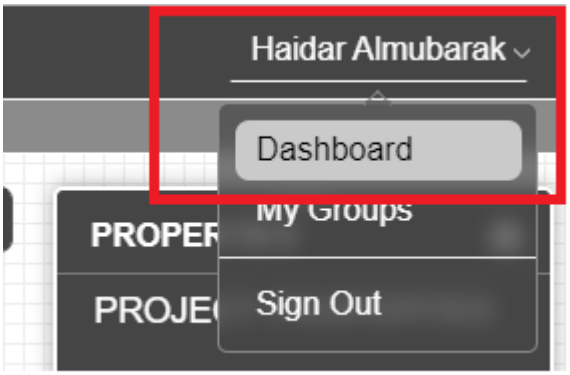
From the sequential elements insert a clock signal and connect it to the clk input of the counter



After finishing all the connections, you can change the input and observe the output to make sure it works as intended. If the values move too fast for you to check you can change the clock time to a higher number.

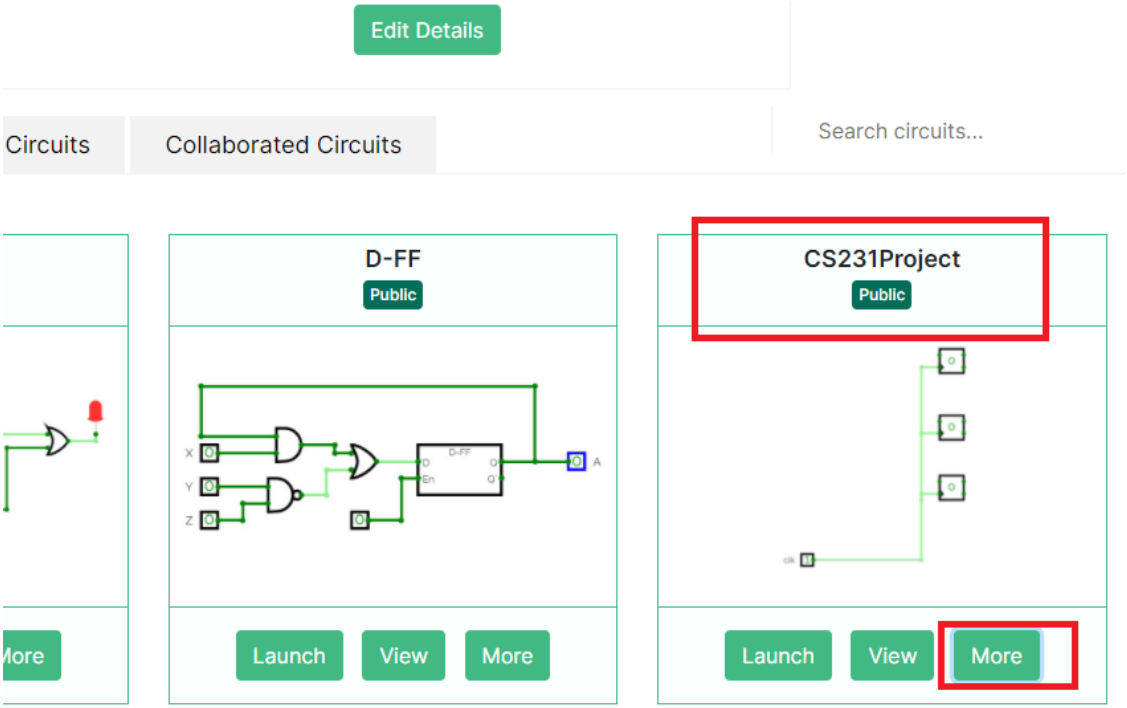
Sharing the design

You can make your project public and share the link or invite your instructor as collaborator using your instructor's email address

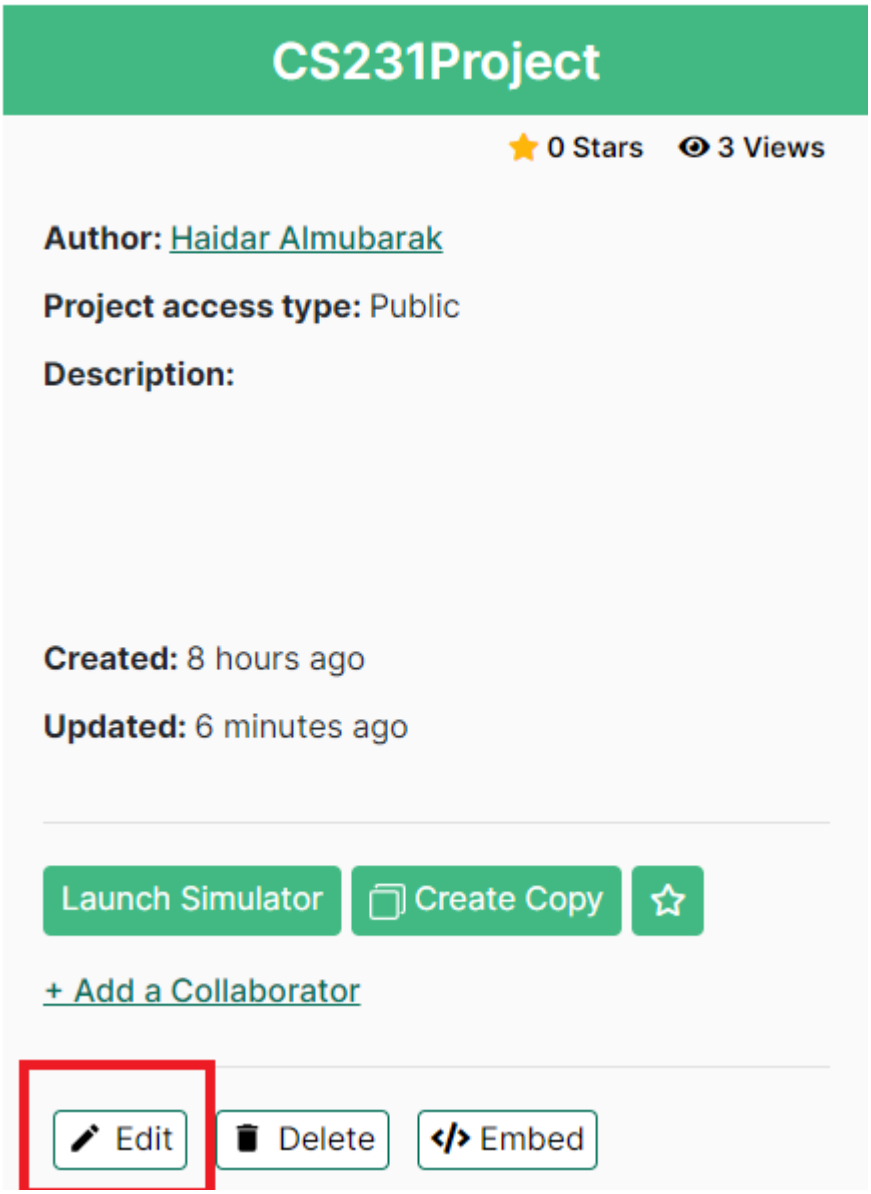


Click your name at the top then click the Dashboard button

Appendix



Find the project name then click more


CS231Project
0 Stars
3 Views
Author: Haidar Almubarak
Project access type: Public
Description:
Created: 8 hours ago
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Launch Simulator
Create Copy
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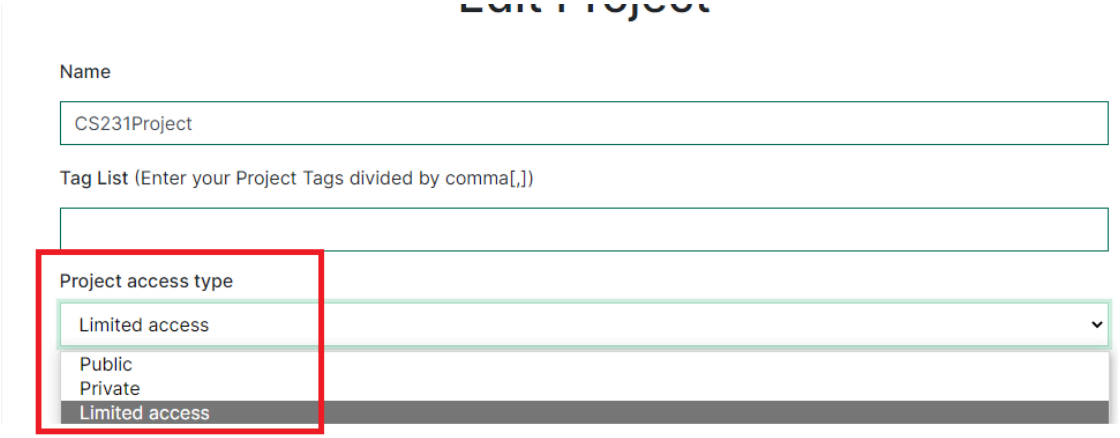
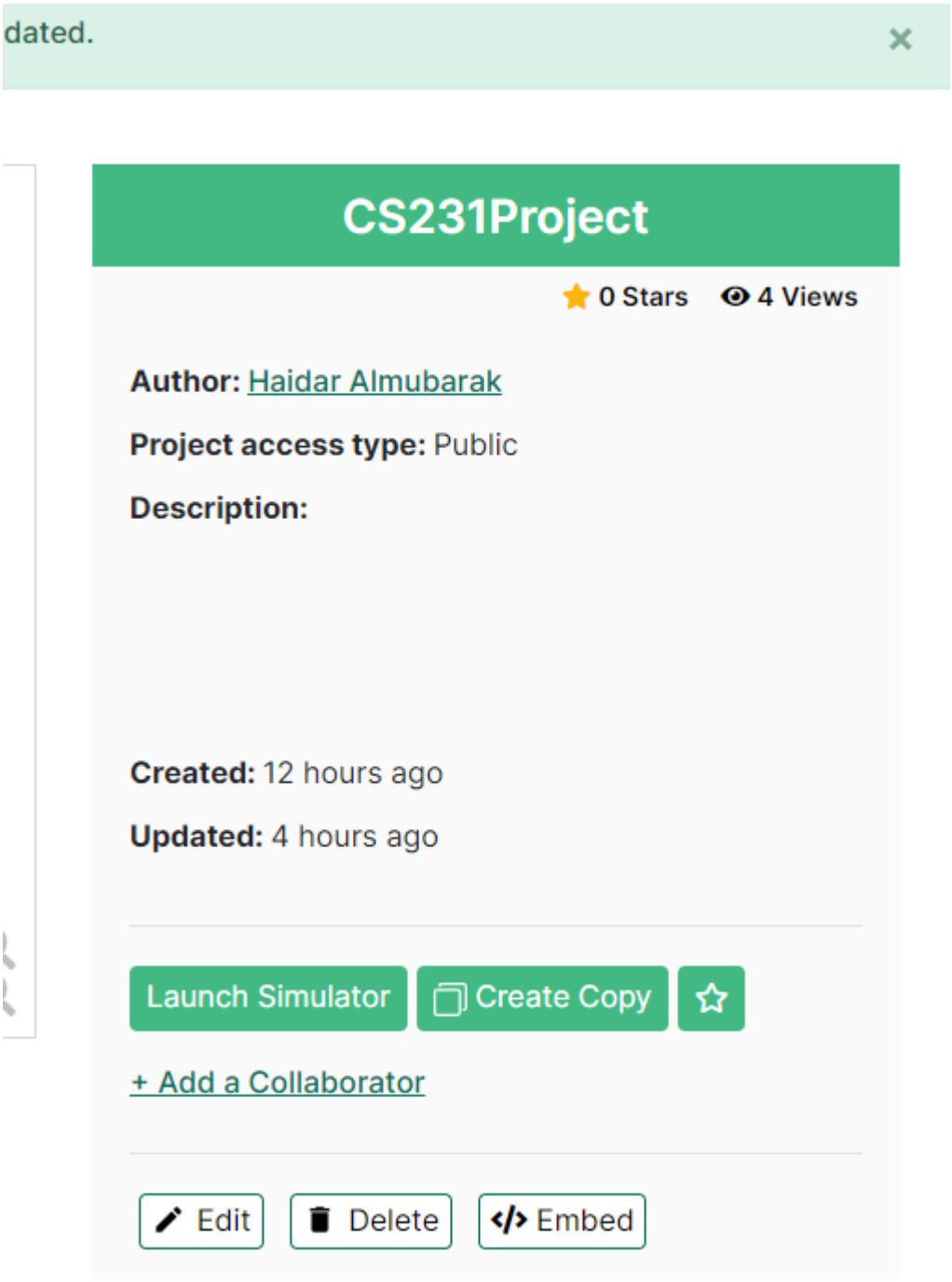
Appendix



In the project access type choose public or limited access

click update the project and you will go back to this page


dated.
CS231Project
0 Stars
4 Views
Author: Haidar Almubarak
Project access type: Public
Description:
Created: 12 hours ago
Updated: 4 hours ago
Launch Simulator
Create Copy
+ Add a Collaborator
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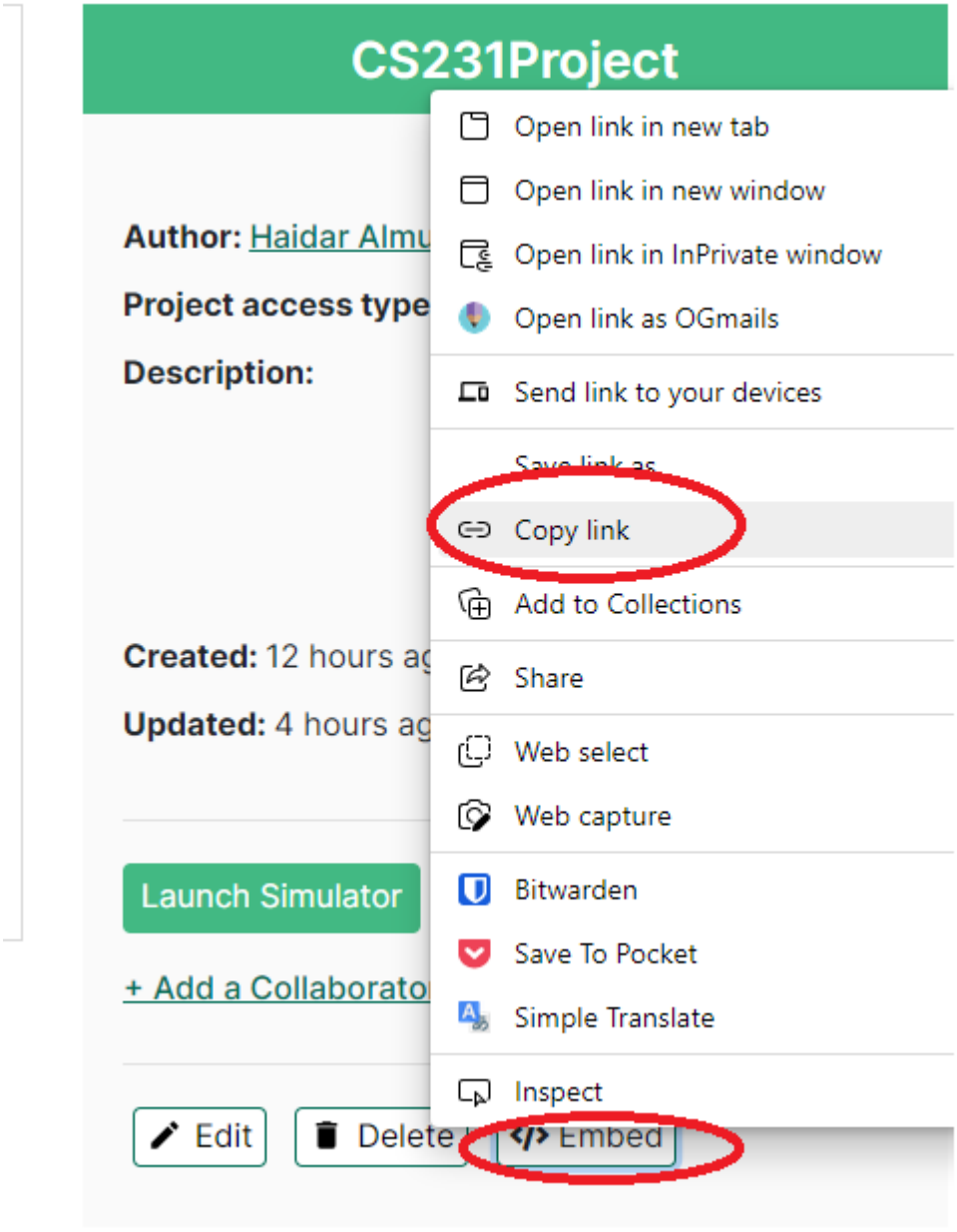
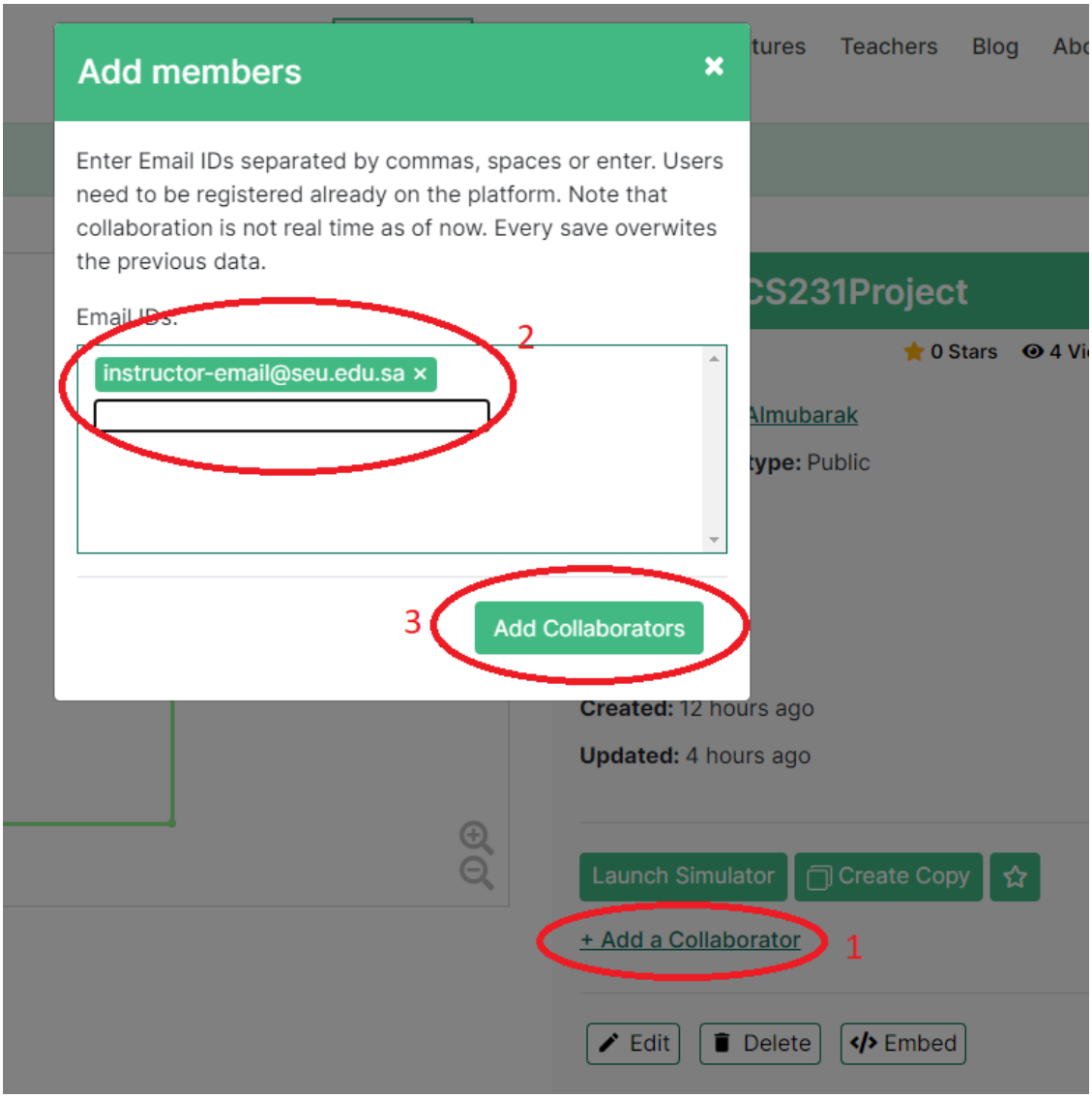
If you choose public



right-click the Embed button and copy the link and add it to your report

If you choose limited access



Click add a collaborator, then type the instructor's email address and click add collaborators

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